

# Management of Post-traumatic Peripheral Arterial Pseudoaneurysm in Antananarivo

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## ABSTRACT

**Background:** Pseudoaneurysm is the usual complication of arterial injury. The aim of this study is to describe the etiology and the management of post-traumatic peripheral arterial pseudoaneurysm in Antananarivo.

**Methods:** This is a bicentric retrospective study for 10 years period (January 2010 to December 2019), performed in Cardiovascular Unit in Joseph Ravoahangy Andrianavalona Teaching Hospital and in Vascular Unit in Soavinandriana Hospital Center, including all patient who underwent a surgical procedure of post-traumatic peripheral arterial pseudoaneurysm.

**Results:** 38 patients were recorded in 10 years period, which 26 patients recorded in JRA hospital and 12 patients in Soavinandriana Hospital. Patients were 33 males (86.84%) and 5 females (13.15%). Gunshots wounds (47.36%) and stabs wounds (34.21%) were the commonest circumstances of etiology. Pulsatile mass (84.21%), pain (60.52%) and palpable thrill (71.05%) were the usual of peripheral pseudoaneurysm. Doppler ultrasound (94.73%) and computed tomographic angiography (13.15%) performed the diagnosis of the pseudoaneurysm. Femoral artery (39.47%) and brachial artery (31.57%) were the most involved vessels. All patients underwent an open surgery. Surgical procedures were arterial repair in 26 patients (68.42%), reversed saphenous vein interposition in 5 patients (13.15%), PTFE graft in 2 patients (5.26%) and ligation excision in 5 patients (13.15%). There was no reoperation or mortality in early postoperative period.

**Conclusion:** Trauma is the most common etiology of pseudoaneurysm in Antananarivo. Open surgical repair remains the procedure to treat the post-traumatic peripheral arterial pseudoaneurysm in our experience.

**Keywords:** arterial injury, pseudoaneurysm, surgery, trauma.

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## I. INTRODUCTION

Pseudoaneurysms or false aneurysm is a disruption in the arterial wall causing a localized pulsatile hematoma contained by a fibrous capsule with a persistent communication of blood flow between the vessel lumen [1].

The most common causes are trauma and iatrogenic following a femoral artery percutaneous procedures. Now, the incidence of post-traumatic peripheral arterial pseudoaneurysm has been increased due to the evolution of cardiac catheterization or endovascular interventions.

According Eleshra's study, the overall incidence of pseudoaneurysm after endovascular intervention for peripheral arterial diseases was 2.75% [2]. If in advanced countries, iatrogenic gesture following a femoral artery percutaneous procedures remain the most common etiology of peripheral arterial pseudoaneurysm, trauma (non-iatrogenic) is the usual etiology published in the most studies and in the clinical cases reported of peripheral arterial pseudoaneurysm in Africa Subsaharian and in Madagascar. However, various recent study has been published the new optionnal therapeutic available to treat a pseudoaneurysm following an in introducing femoral artery percutaneous

catheter for a cardiac catheterization, a transcatheter aortic valve implantation (TAVI) or an endovascular surgery. Few studies of a post-traumatic peripheral arterial pseudoaneurysm have been published in african literature. The aim of this study was to describe the etiology and management of post-traumatic peripheral arterial pseudoaneurysm in Antananarivo.

## II. METHODS

Author conducted a retrospective, bicentric and descriptive study for a 10 year period from January 2010 to December 2019, performed at Cardiovascular Surgery Unit in Joseph Ravoahangy Andrianavalona Teaching Hospital and in Soavinandriana Hospital Center in Antananarivo.

Inclusion criteria: all patients who admitted for a post-traumatic peripheral arterial pseudoaneurysm managed by surgical procedures were included in the study.

Exclusion criteria: true aneurysm of peripheral artery, non-traumatic pseudoaneurysm (mycotic).

Demographic data, etiology of arterial injury, clinical signs, diagnostic imaging, artery involved, surgical procedures and earlier postoperative results were analyzed. Statistical analysis was performed by use of the SPSS® 21 statistics software program.

## III. RESULTS

Thirty-eight patients were recorded in period of 10 years which 26 patients recorded in JRA hospital and 12 patients in Soavinandriana Hospital. There were 33 males (86.84 %) and 5 females (13.15 %), giving a sex ratio of 6.6. The average age was 32.24 years old, ranged from 17 to 63 years old. There was any case of paediatric pseudoaneurysm. The most common victims (76.31%) were younger men under 41 years old (Table I).

TABLE I: CHARACTERISTICS OF PARTICIPANTS

Characteristics of participants		No. of Patients (Total=38)	Percentage (%)
Gender	Male	33	86.84
	Female	5	13.15
Age	10-20	1	2.63
	21-30	16	42.10
	31-40	12	31.57
	41-50	5	13.15
	51-60	3	7.89
	61-70	1	2.63

The most arterial injury was due to stabs wounds (34.21%) and gunshots wounds (47.36%) (Table II). Only 15.78% of pseudoaneurysm was due to iatrogenic gesture, with 5.26% following dialysis catheter induced and 10.52% due to vascular anastomosis disruption.

TABLE II: MECHANISM OF ARTERIAL INJURY

Mechanism of arterial injury		No. of Patients (Total=38)	Percentage (%)
Trauma	Stab wounds	13	34.21
	Gunshots wounds	18	47.36
	Broken bottle	1	2.63
	Dialysis catheter induced	2	5.26
Iatrogenic	Vascular anastomosis disruption	4	10.52

The commonest clinical signs were localized swelling (100%), pulsatile mass (84.21%), pain (60%) and palpable thrill (71%) (Table III). The diagnosis was performed by using doppler ultrasonography (94%) and CTA (13%).

TABLE III: DIAGNOSTIC MODALITIES

Diagnostic modalities		No. of Patients (Total=38)	Percentage (%)
Clinical signs	Pulsatile mass	32	84.21
	Pain	23	60.52
	Bleeding	8	21.05
	Palpable thrill	27	71.05
	Localized swelling	38	100
Imaging modality	Duplex ultrasonography	36	94.73
	Computed tomographic angiography (CTA)	5	13.15

Fig. 1 showed a case 1 of patient who presented localized swelling with pulsatile mass on palpation of the left thigh.



Fig.1. Localized swelling of the left thigh (Case 1).

Fig. 2 and 3 showed a multiplanar view of left femoral superficial artery pseudoaneurysm of this patient (Case 1) on computed tomography angiography (CTA) with injection of iodized contrast.

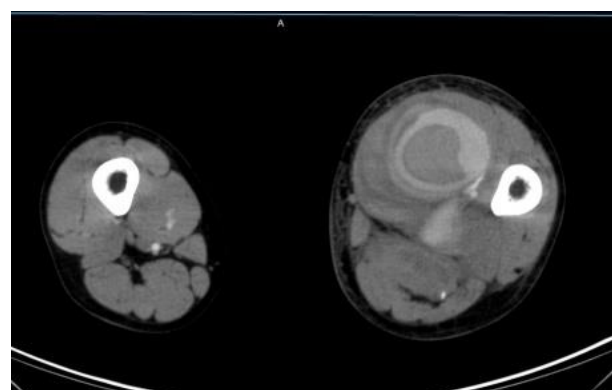


Fig. 2. Left femoral artery pseudoaneurysm in axial view on CTA with injection of iodized contrast.

Pseudoaneurysm were located in upper limbs in 18 patients (47.36%), in lower limbs in 18 patients (47.36%) and in the neck in 2 patients (5.26%). Femoral artery (39.47%) and brachial artery (31.57%) were the most involved arteries (Table IV).



Fig. 3. Left femoral superficial artery pseudoaneurysm in coronal view on CTA with injection of iodized contrast.

TABLE IV: LOCATION OF PSEUDOANEURYSM AND ARTERY INVOLVED

Location and artery involved		No. of Patients (Total=38)	Percentage (%)
Upper limbs	Brachial artery	12	31.57
	Radial artery	6	15.78
	Femoral artery	15	39.47
Lower limbs	Popliteal artery	2	5.26
	Anterior tibial artery	1	2.63
Neck	Carotid artery	2	5.26

Fig. 4 showed a peroperative image of this patient who presented a left pseudoaneurysm of a superficial femoral artery (Case 1).

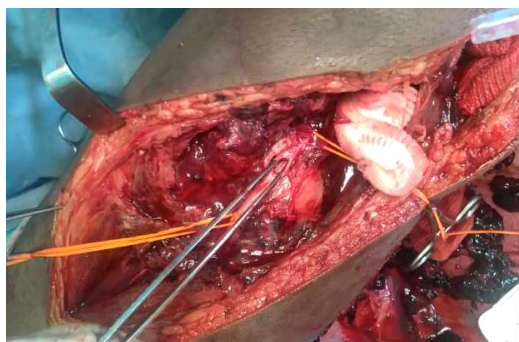


Fig. 4. Peroperative image of the left femoral superficial artery pseudoaneurysm (Case 1).

Surgical management were a primary arterial repair in 26 patients (68.42%), reversed saphenous vein interposition graft in 5 patients (13.15%), PTFE graft in 2 patients (5.26%) and ligation with excision in 5 patients (13.15%).

TABLE V: SURGICAL PROCEDURES

Surgical procedures		No. of Patients (Total=38)	Percentage (%)
Primary repair	Brachial artery	12	31.57
	Radial artery	2	5.26
	Femoral artery	8	21.05
	Popliteal artery	2	5.26
	Carotid artery	2	5.26
Saphenous vein interposition graft	Femoral artery	5	13.15
PTFE graft	Femoral artery	2	5.26
Ligation excision	Radial artery	4	10.52
	Anterior tibial artery	1	2.63

Fig. 5, 6, 7 showed another patient (Case 2) who presented a pseudoaneurysm of left thigh with transfixiant lesion of femoral superficial artery in peroperative image. It has been treated by a reversed saphenous interposition.



Fig. 5. Clinical presentation of pseudoaneurysm of the left femoral superficial artery after a gunshot wound (Case 2).

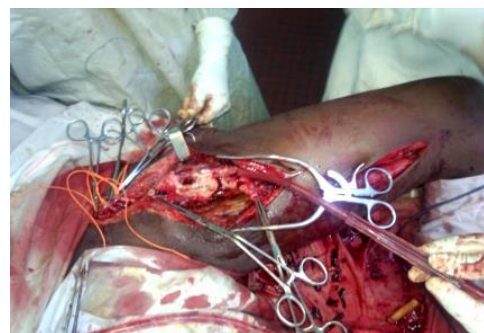


Fig. 6. Transfixiant lesion of the left femoral superficial artery on preoperative image (Case 2).

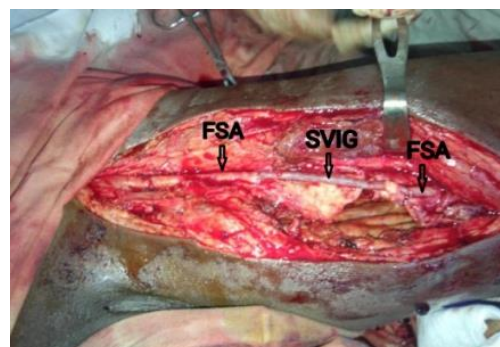


Fig. 7. Saphenous vein interposition graft (SVIG) to treat a femoral superficial artery (FSA) pseudoaneurysm (Case 2).

There was no reoperation or mortality in early postoperative period. Immediate postoperative successful rate was (89.47%). Four patients (10.52%) have been presented an earlier postoperative complication: 1 arterial thrombosis, 3 surgical site infections.

IV. DISCUSSION

Pseudoaneurysms is a disruption of all three layers of the arterial wall (intima, media, and adventitia), giving a localized pulsatile hematoma contained in a fibrous capsule. Peripheral arterial pseudoaneurysm could constitute after an arterial trauma, infection (mycotic), intravenous drug abuse, and neoplasm. Trauma or iatrogenic remain the usual causes of pseudoaneurysm in peripheral artery [3].

In advanced countries, most studies showed the frequency and the management of peripheral arterial pseudoaneurysm



after a femoral artery introducing catheter for an endovascular surgery or a cardiac catheterization. However, few studies have been published the peripheral arterial pseudoaneurysm after direct trauma. The frequency of peripheral arterial pseudoaneurysm after a non iatrogenic trauma published in the literature is different according to the study. During the 10-years period of study, Luther A recensed 50 cases of peripheral arterial pseudoaneurysm [3]. Darbari A recensed 60 cases of post-traumatic peripheral arterial pseudoaneurysms in the same 10-years period of study [4]. In our study, 38 cases of post-traumatic peripheral arterial pseudoaneurysms have been observed during our 10-years period of study. However, Jaiswal's et al recensed 32 cases of peripheral arterial pseudoaneurysm only in 45 months period of study [5]. Now, there was most studies available publishing a femoral arterial pseudoaneurysms after an iatrogenic trauma. Audeh's study showed 60 cases of iatrogenic giant femoral artery pseudoaneurysms among 1850 patients who underwent both percutaneous cardiac catheterization and peripheral vascular interventions after transfemoral artery puncture for 10 years period of study [6]. Gummerer M recensed 55 cases of femoral iatrogenic pseudoaneurysm following peripheral arterial interventions and treated using Ultrasound-Guided Fibrin Injection (UGFI) during 9-years period of study [7].

There was a predominance of young male in our study. The average age was 32.24 years old with 86.84% of male. This predominance of young male in our study is similar as in Jaiswal's study [5], in Luther's study [3] and in Darbari's study [4]. Jaiswal's study showed a median age of 42 years old with 68.7% of male [5]. In Luther's study, there were 29.5years of mean age and 88% of male [3]. Darbari A recensed 88.3% of male with 29.5years of mean age [4]. This predominance of male could be explained by the higher level of activity or mobility of the male gender that exposes them to various vascular trauma. There was any case recorded of paediatric pseudoaneurysm in our study. Few cases of paediatric post-traumatic peripheral arterial pseudoaneurysm have been reported in litterature [8].

The initial trauma of the peripheral arterial pseudoaneurysm could be an iatrogenic or a non-iatrogenic (direct trauma). In Luther's study, the most common cause of peripheral arterial pseudoaneurysm was an intravenous drug abuse (52%) followed by trauma (18%) [3]. In Jaiswal's study, the most common causes of pseudoaneurysm in peripheral arteries were iatrogenic trauma (46.9%) which 25% were induced by dialysis catheter, intravenous drug abuse (31.3%) and trauma (18.7%) [5]. In advanced countries, percutaneous vascular access is the commonest causes of traumatic peripheral artery pseudoaneurysm [7, 9]. Trauma remain the most common cause of post-traumatic peripheral arterial pseudoneurysm in our study (84.21%), which 47.36% was due to gunshots wounds and 34.21% of cases was due to stabs wounds. Only 15.78% of peripheral arterial pseudoaneurysm recensed in our study was due to iatrogenic trauma. However, Yetkin's study showed a similar result of our study in the predominance of stab wounds (56%) and gunshot wounds (44%) [10]. This predominance of non iatrogenic trauma in etiological mechanism of peripheral arterial pseudoaneurysm in our study and could be related in the absence of an endovascular surgery in Antananarivo and

the predominance of stab wounds and gunshots wounds in the etiology of post-traumatic peripheral vascular injury in Antananarivo [11]. Our result is similar in other studies published in countries of sub-saharan africa as in Seyoum's study which 83% was due to trauma and the commonest etiologies were stab (46%) and gunshot (21%) [12]. However, orthopedic trauma is an uncommon cause of peripheral arterial pseudoaneurysm as in Devendra's study [13].

The commonest clinical signs were localized swelling (100%), pulsatile mass (84%), pain (60%) and palpable thrill (71%). These signs were observed in Jaiswal's study [5] and Luther's study [3]. Jaiswal's study showed a similar Seyoumresult with 93% of pulsatile mass, 68% of pain and 37% of palpable thrill [5]. The most clinical signs were pulsatile mass (72%), localized tenderness (76%) and ecchymosis (56%) in Luther's study [3]. Different variety of imaging modalities could be used to make the diagnosis of peripheral arterial pseudoaneurysm. Duplex ultrasonography was the commonest imaging used for the diagnosis of the peripheral arterial pseudoaneurysm in our study (94%). In our practice, duplex ultrasonography would give an easily possibility of all patients because it's still available and offering a low-cost than computed tomographic angiography. Although, some authors showed the role of ultrasound to guide compression [14] or percutaneous injection of thrombin for the treatment of pseudoaneurysm [15]. In Seyoum's study, 92% of patients has been diagnosed by using Doppler ultrasonography and 46% were evaluated by using Doppler ultrasonography and CT angiography [12].

Most studies in peripheral arterial pseudoaneurysm showed the predominance of femoral artery and brachial artery in the most involved vessel [3]-[5], [12], [16]. Our study showed a result similar of these studies in the predominance femoral (39%) and brachial artery (31%). The predominance of femoral artery in peripheral arterial pseudoaneurysm observed in advanced countries could be explained that femoral artery is the most common site of percutaneous arterial access for an endovascular surgery or cardiology interventional procedures.

However, Femoral artery and brachial artery are the most site of injury published in peripheral arterial pseudoaneurysm after a non-iatrogenic trauma [17], [18].

Now, many procedures could be used to treat a post-traumatic peripheral arterial pseudoaneurysm. Management could be a surgical procedures or non-surgical procedures as an ultrasound-guided compression repair or an ultrasound-guided thrombin injection for a femoral artery pseudoaneurysm after percutaneous procedures. In our study, all patients underwent an open surgical treatment. Surgical management were a primary arterial repair in 26 patients (68.42%), reversed saphenous vein interposition graft in 5 patients (13.15%), PTFE graft in 2 patients (5.26%) and ligation with excision in 5 patients (13.15%). Our study showed a similar result as in Luther's study [3], as in Seyoum's study about using surgical treatment in all patients [12]. In Seyoum's study, the most surgical modality was interposition grafting (32%), primary repair (29%) and venous patch (24%) [12]. However, there was a higher rate of arterial ligation (72%) in Luther's study than in our result. Nevertheless, venous grafting (63%) was the most surgical

management in Darbari's study [4]. In Jaiswal's study, surgical procedures were ligation of artery and debridement (46%), primary repair (28%) and venous graft bypass (15%) [5]. Because of higher risk of infection and risk of prolonged the duration of hospitalization in postoperative time, some surgeons preferred to treat the peripheral arterial pseudoaneurysm by using a non-surgical procedure. Recently, therapeutic options have evolved from the open surgical option to mini invasive surgery as an ultrasound-guided compression (UGC) since the first described by Fellmeth in 1991 [19] or an ultrasound guided thrombin injection (UGTI) since the first described by Cope in 1986 [20]. According Kontopodis's study, ultrasound guided thrombin injection is superior in terms of efficacy than ultrasound-guided compression and thus should be used as the primary modality for the treatment of post-catheterization femoral pseudoaneurysms [21].

In our study, the immediate postoperative successful rate was 89.47%. Four patients (10.52%) have been presented earlier postoperative complications: 1 arterial thrombosis, 3 surgical site infections. Darbari's study showed 16% of complication in 60 patients presented post-traumatic peripheral arterial pseudoaneurysms who underwent surgical intervention [4]. Infection was the commonest complication published in non-iatrogenic peripheral arterial pseudoaneurysm treated by surgical procedure. The rate of infection after an open surgical procedure was 7% in our study, 36% in Luther's study [3], 22% in Seyoum's study [12], 43% in Jaiswal's study [5] and 5% in Darbari's study [4].

## V. CONCLUSION

Gunshots wounds and stab wounds is the most common etiology of post-traumatic peripheral arterial pseudoaneurysm in Antananarivo. Open surgical procedures remain the therapeutic option to treat the post-traumatic peripheral arterial pseudoaneurysm in our experience.

## CONFLICTS OF INTEREST

All authors have declared that they have no conflict of interest in the submitted work.

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